TrikeTronics

No.5
Power Circuits and Metals
www.asmrstudio.com

Brushless vs Brushed, Gasoline vs Diesel

Motorized bicycles began in the 19th century or earlier. Pedal bikes require no license. Exceeding 120 kg (256lbs) or surpassing 32km/r (500w) disqualifies e-bikes from bike trails.

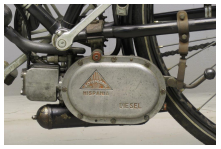
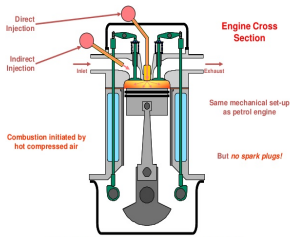


Image : Lohmann 1953 Batavus 18cc ts Diesel 2712



Gasoline requires a spark plug to combust fuel in a piston. Diesel engine piston(s) combust via pressure. E-bikes use batteries. Brushless motors windings are stationary to rotor magnets, enabling torque to speed ratio efficiency. Brushed motors bundle wires on axle and commutator reverses polarity with contact brush. Convert horsepower and cubic centimeters to Watts. **1 hp(I) = 745.7 W , 1cc = 0.03 hp**

Power Wattage Rating = Voltage (V) x Current (I)

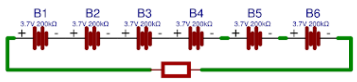
350w / 71cc - Flat Roads, Inner City, 25V pack = 14amp (I), Hoverboards
500w - Cross City Commutes, 50V pack = 10amp (I), Bicycles, Tricycles
750w - Hills and Valleys, Rural Travel, 50V pack = 15amp (I)
Battery Packs rated in Amp Hours. 1hr @ 750w @ 15amps / hr, needs 15Ah / hr.

Brace Motors to Threaded Bike Forks.

Main cable connecting battery to motor must handle high amperage (particle velocity) and needs large diameter wire to push current through, otherwise melt occurs. Primary housing cable is rated to push 10 amps or more (fuse box knows). American Wire Gauge (AWG) specifics listed on cable sheath. Primary household wiring is AWG number 12 or 14 (10 to 7 amps).

powerstream.com/Wire_Size.htm

Parallel and Serial



Six batteries in series stacked + to -

When stacked end(-) to front(+), voltage pressure builds and internal resistance raises. 6 x 3.7 volt batteries = 22.2v.
When the batteries are charged to thier 4.2 Volt rating, 6 x 4.2v = 25.2v. Batteries in circuits creates resistance as a load charging and when a power source. Over discharging increases internal resistance until battery chemistry is clogged. Resistance is electron velocity slowdown into electromotive force, heat loss through an insulator or resistor, or semiconductor luminescence, or >1ø (two phase or more) alternating current resistance.

Series (stacked - to +)	$V_S = V_1+V_2$	Parallel (bundled + to + and - to -)	$V_P = (V_1 + V_2) / V_T$
Resistors in Series	$R_S = R_1 + R_2 + R_3$	Parallel Resistance	$R_P = (R_1 + R_2) / R_T$
Inductors in Series	$L_S = L_1 + L_2 + L_3$	Parallel Inductance	$L_P = (L_1 + L_2) / L_T$
Inductor Ω in Parallel	$R_P = R_1 + R_2 + R_3$	Inductor Ω in Serial	$R_S = (R_1 + R_2) / R_T$
Parallel Capacitance	$C_P = C_1 + C_2 + C_3$	Capacitors in Series	$C_S = (C_1 + C_2) / C_T$

Sony 26650* Internal Resistance ≤15mΩ High Drain (High Velocity) 10amp+, 1-3aH

Sealed 12v Lead Acid (SLA) Low Drain (Low Velocity) 1 amp continuous Drain, 7aH+

Sealed 12v Lithium LiFePo4 HD 1 to 5 amp continuous drain, 10 amp max drain, 10aH+

38120* Headway High Drain, High Velocity, Nut and Bolt Assembly. 8aH+

Gravimetric Energy Density

Lead Acid 20Wh/kg, NiCd 40Wh/kg, Ni-MH 80Wh/kg, Lithium 160Wh/kg

*Hard Metal Case - Requires Soldering and/or Spot Welding

Battery Pack Assemblies

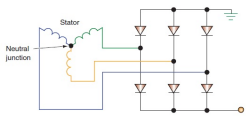
12 x 18650* (3.7v x 2200maH) in serial = 44.4v @ 2200maH or 49.2v charged @ 4.1v
12 x 18650* (3.7v x 2200maH) in parallel = 3.7v @ 26400maH or 4.1v charged
4 x SLA (12v x 7aH) in serial = 48v @ 7000maH or 44v charged @ 11v
4 x SLA (12v x 7aH) in parallel = 12v @ 21000maH or 11v charged

Would you like to Know More? www.asmrstudio.com DrDoubleDragon@gmail.com

Alternators and Rectifiers

1 Horsepower = 16 cc (Cubic Centimeters) = 746 Watts

Alternating Current (AC) is generated magnetically, whether it be nuclear steam spinning turbines, gas engines propelling, or the wind turning a magnetic stator (Alternator) and rectifiers can convert that AC wave signal into a dense direct current (DC) signal.

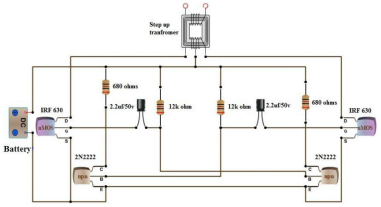


A/C to D/C Bridge Rectifier (Inverter)

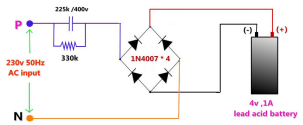
The "Y" stator taps the 3 phase Alternating Current and connects to a diode bridge for rectification.

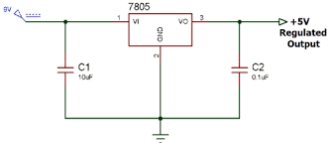
D/C to A/C Inverter 12v DC to 220v ac. Gives about 35 watt output. Add more MOSFETs to get more output. Step up Transformer, 2n222x2, 12kΩx2, 680Ωx2, IRF 630x2, 2.2uf50Vx2.

instructables.com : tinyurl.com/yxhftspj



Full Wave Rectifier, Tank Circuits, and Battery Charging



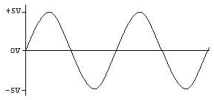


Tank Circuit: a capacitor (330kΩ) and resistor (225kΩ / 400V) in parallel that absorbs max power at a particular frequency (called the resonant frequency)

Full Wave Rectifier: 4 semi-conducting (unidirectional) diodes (1N4007) conform a full A/C signal into a D/C electric pressure signal, by blocking reverse negative voltage.

Linear Regulator (Voltage Valve IC)

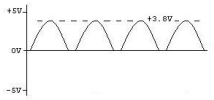
When charging a battery rated to 4.2 volts, set the maximum voltage pressure the same with a linear regulator voltage valve. Capacitors in parallel amperage cross Ohm's Law, Voltage is Pressure = Heat is Resistance / Current is Velocity.



A/C Voltages/Current Switch Polarity/Magnitude

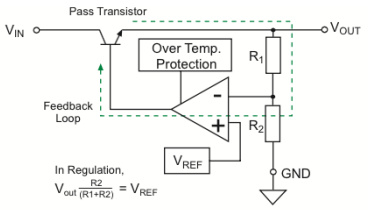
Battery Chemistry is Flat D/C

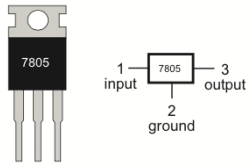
A/C and D/C voltage waves represent pressure and vacuum



A/C Rectifier to D/C Voltages/Current Maintain Polarity

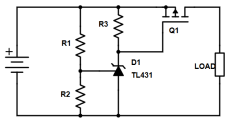
A/C fails with pressure blasts. DC seizes muscles, fails with heat, melt and fire.



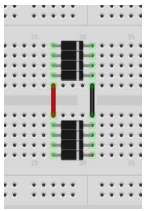


Zener Diode Shunt Regulator

A shunt regulator is the Zener diode regulator circuit. Operation is straightforward. Once over its small minimum current, the Zener diode maintains an almost constant voltage across its terminals.



Mosfets as Battery Protection Circuits These valves close when voltage drops below thier given rating. Electricity flows from negative to positive, so a low side connection acts as a fuse does when voltage drops.



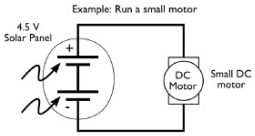
DIY SOLAR PANEL

Connecting diodes (silicon, gallium, arsenide and/or germanium) in parallel will collect the maximum amperage and a reduced voltage level. Diodes will produce the most electricity under direct sunlight. If there is no sunny day, a halogen lamp will suffice. Most I was able to produce from this setup was 300 millivolts. Voltage affected by diodes and light source. Expect 10+ watts per square foot from commercial products.

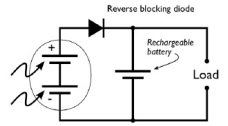
SIMPLE SOLAR CIRCUITS

evilmadscientist.com/2008/simple-solar-circuits/

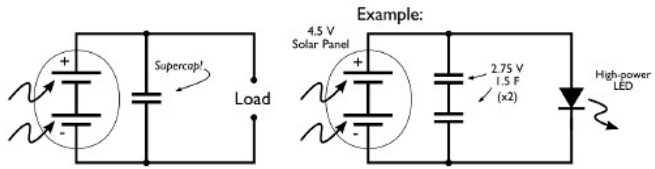
Direct Drive: Connect load directly to the solar panel output. In sunlight, the motor starts to spin. Circuit provides no energy storage, and might blink when semiconductors are in shade.

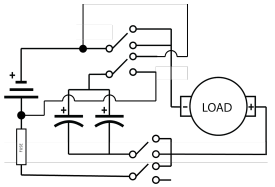


Interruption-resistant direct drive: A power interruption can be disruptive to a clock. Powering lights during interruption causes blinking, blue LEDs easily withstands 50-90 mA over a 20mA "regular" LED. Adding a supercapacitor as a battery keep the circuit running at capacity.



A diode blocks voltage pressure from returning into the solar panel. The forward voltage must be exceeded by the series voltage total, before current is allowed to pass into the circuit. Choosing a capacitor over a rechargeable battery will have a similar interruption resistant effect. Powering down devices with smooth drain, lights tend to fade and motors tend to slow down rather than cease. Capacitors hold charge in the same way batteries do without the chemistry. The battery to the left was taken from a microwave and has high voltage capacity. Capacity cannot exceed voltage supplied to it.

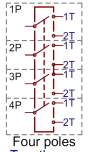


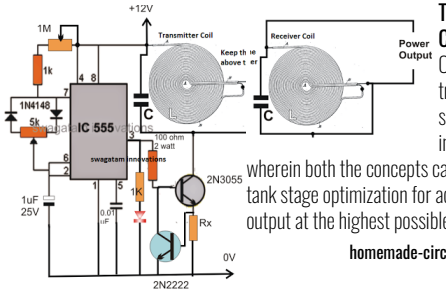


Ben Franklin got it wrong, and schematics have been a mess ever since. Electrons are now known to flow from negative to positive. Fuse in this arrangement is ready to blow before the electron velocity destroys motor windings.

Four Poles Two Throws (4P2T) Booster Switch

Capacitors bundled in parallel charge from battery. A switch throw maintains polarity and stacks capacitors start to end, in series with battery.





Transmitter and Receiver Coil in Wireless Chargers

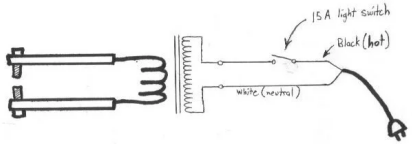
Optimizing a wireless power transfer circuit is quite similar to optimizing an induction heater circuit, wherein both the concepts can be seen utilizing the LC tank stage optimization for achieving the desired power output at the highest possible efficiency.

homemade-circuits.com : tinyurl.com/y5lxrtf4

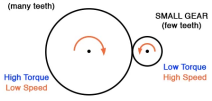
(A) High-carbon steel (C) Tungsten steel
(B) Manganese steel (D) Molybdenum steel

Welding Form a relationship with a welder to do a prespecified job, it's worth paying. Batteries bundle with shrinkwrap and heat. Canister packs may need spot welds, crimps or +80 watt soldering. Electrical tape and twists shake apart. Copper bike frames may require brazing with open flame. Steel requires electrical arc contact point welding. Pure aluminum is lightweight, will not spark when angle grinding, heats fast, and incinerates, as it is dissolved 3.6 / 1 ton ratio from bauxite (Al_2O_3) rocks (Bayer Process), Carbon, and silicon (Si) won't spark either, yet they make the best battery anodes known to man. Lead dioxide cathodes on lead acid battery packs spark due to oxidizing electrons. Pure lead without oxides has no spark.

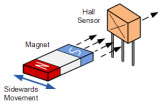
DIY Spot Welder from an old Microwave Transformer
You will need a 000 solid AWG copper wire or equivalent bundled, insulated wire. This wire is bigger than primary. Salvage Step transformer from microwave. Hacksaw or grind out secondary winding, replace with copper wire wound 3x.
instructables.com/id/Homemade-Spot-Welder/



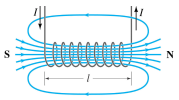
A/C voltage waves cycle from (+) vacuum to positive (-) pressure through wires producing a magnetic teeth-sprocket pattern similar to mechanical gears. This idea as seen in the spot welder allows one to step up or step down voltage into a seperate receiving wire winding. Windings from the wall outlet are transformed into low voltage, high amperage on the secondary coil. Toroidal transformers overlap primary and secondary windings reducing noise for isolation in sound amplification applications rather than power transformations. Watts output is VA rated. Voltage x Ampere = Watts (Power). Power in Primary Winding = Power in Secondary Winding. 100 turns to 25 turns = 100|25 ratio. No energy is lost in an ideal transformer. Voltage is converted into amperage in a step down, and amperage is converted into voltage in a step up. Power loss dissipates through the transformer core material.

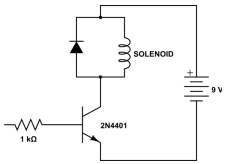


Hall Effect Sensor and Pedal Assists
Both mechanisms are based on magnets perturbing an electric current. Both voltage and amperage change with each pass from a magnet increasing ohmic resistance through the hall sensors.

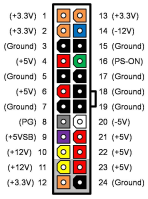


Solenoids : Magnetic Propulsion Amperage velocity through a wire creates magnetic fields. Fluctuating A/C voltages tends to hold objects in magnetic field center, while D/C voltages propel directionally. Solenoids used in water pump valves, and door locks.



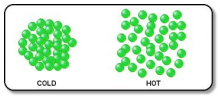


Circuit uses an NPN amperage valve to switch on the solenoid. Diode blocks reverse voltage pressure using semiconductor material. The 1K resistor is connected to a different power supply, and can be controlled via a throw switch or a variable resistor / potentiometer. Short circuit a solenoid by removing the transistor.



SALVAGE AN ATX COMPUTER SUPPLY

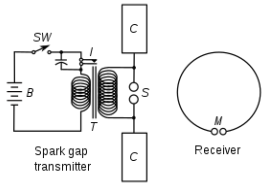
Shorting out an ATX power supply at green to black turns ATX on. Connecting an orange (+3.3v), red (+5v) or yellow (+12v) to your circuit and grounding at black makes powering battery charger circuits possible upto the voltage maximum rating. 300W is typical, with 2x 12v rails availability or more.



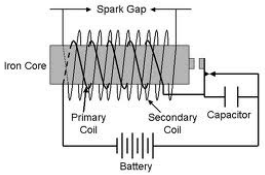
Atoms and Heat - University Course - Drained batteries raise resistance overheating battery internal electrolytes and/or anodes. Space between fast kinetic atoms insulate.
youtube.com/watch?v=ze720kEy6pI

Pulse Charging Increases Life Cycle Pulse charging at the optimal values results in 100 additional cycles. Your results may vary. **mdpi.com/1996-1073/11/8/2162/pdf**

Extending Lead Acid Battery Life by adding Water When your battery's electrolyte is observed to be low, fill the battery with water. **crownbattery.com : tinyurl.com/yyn4ugd2**



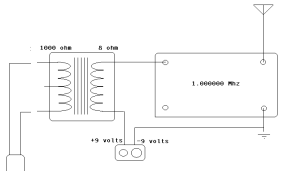
<<< Spark Gap Induction Coil - Spark Radio
1780-1784: George Adams notices sparks between charged and uncharged conductors when a Leyden jar was discharged nearby.



Induction Coil astarmathsandphysics.com : tinyurl.com/yyy4se8y
The induction coil in spark air fuel mixture ignition petrol combustion chamber engine system. Two coils, a primary and secondary, both wound on an iron core. A current flows in the primary coil and magnetises the iron core, which attracts the armature and breaks the circuit. The magnetic field inside the core falls and the armature is released. The circuit is complete again, current flows, the iron core is magnetised and the process repeats. The rapidly changing magnetic field produces a changing voltage in the primary coil. A large voltage is induced in the secondary coil because of the larger number of turns, and because a capacitor connected between the contacts causes the magnetic field to die away very rapidly when the contacts are broken.

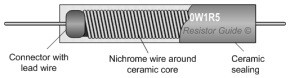
Bearings and Axle Suspension ¾ inch through ½ inch axles can be cut to length at a steel shop and bearings to fit inside tube frames and wheel hubs. Aluminum rims for trike back ends will snap on hard turns. Seamless steel rims are better.

QUARTZ CRYSTAL OSCILLATOR - AM RADIO - Sci-Toys.com

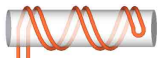


A crystal oscillator in an electronic oscillator circuit that uses vibrating piezoelectric crystal mechanical resonance material to create an electrical signal with a precise frequency. The coils are a transformer. Wrap two, equal-length steel bars, on each, wind one hundred turns magnet wire, then electric-insulating tape. Make each winding an equal or unequal number of turns, depending on whether or not you want the transformer to be able to "step" voltage up or down.

HOW TO MAKE WIRE WOUND RESISTORS **resistorguide.com/wirewound-resistor/**

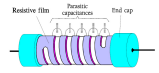


Nickel-chromium (Nichrome) is used in heating elements, and when wrapped around a ceramic core, creates electrical resistance.

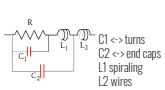


Low inductance winding method, illustrated and placed in the Public Domain by the Zureks. **cappels.org : tinyurl.com/y396jzex**

Ayrton–Perry windings make wirewound RF resistors that are used at high frequencies, where inductance and capacitance are unwanted.

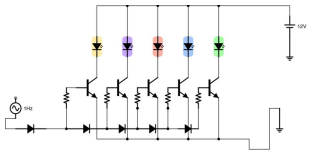


Non Wirewound Resistor Metal Film Oxide The most dominant resistor is metal film and prone to flame. Film resistors may be approximated at values < 100Ω inductive, between 100Ω and 470Ω are practically true resistive and above 470Ω are capacitive. figure shows stray capacitance between turns. Coil gets inductance and spiraling produces frequency dependent impedance where the capacitance is dominating. **passive-components.eu : tinyurl.com/y43cvehk**



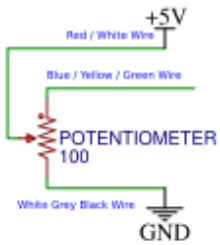
LED - VU METER (VOLUME UNIT)

instructables.com/id/Led-VU-Meter-2/
We are using the "Tip 31C" Standard transistor, rated at max 5V and 1A for a total 5Watts. Most transistors will work. Diodes with 0.6V forward voltage. Most diodes are rated near this. A potentiometer (100k for this one) To adjust sensitivity on the bar. 10k Ω Resistors in parallel dividing voltage. Wires! The LED's shine less the further away it is in the bar. Continue adding a diode, then connecting the end to a base with a resistor (10k ohm).

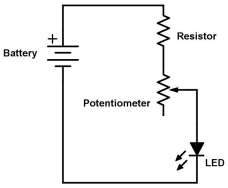


Perforated boards, wood, cardboard are great insulators and metal twist wires avoid soldering.

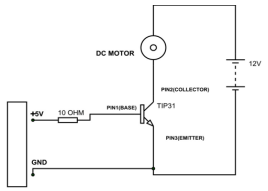
5 Volt Electric Throttle (Variable Resistor / Potentiometer)



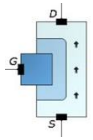
Above: high current, high resistance potentiometer



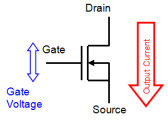
Above: typical wiring on direct current light dimmer

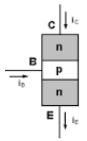


5V variable resistors make ebike throttles and D/C light dimmers. Ohm's Law says V = I*R. Raising resistance (R), lowers current electron velocity, amperage (I) increasing voltage pressure (V). Power (W) is measured in Watts and is the product to Volts (V) x Amperage (I)

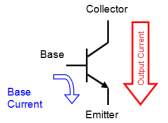


Voltage Valve, Mosfets Jfets (field effect transistors), (Gate, Drain, Source) Voltage pressure to the gate, opens drain to source. Metal particles dispersed into crystal matrices such as glass or quartz is the semiconducting material.





Amperage Valve, BJT (bipolar junction transistors), (Base, Emitter, Collector) Amperage velocity to the gate opens collector to emitter. Silicon used in semiconducting diodes is used in PNP and NPN transistors.



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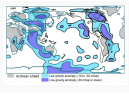

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